

**STATUTORY DECLARATION**

I, Kyung Gu KANG, a citizen of the Republic of Korea and a staff member of Y.H.KIM INTERNATIONAL PATENT & LAW OFFICE specializing in "APPARATUS AND METHOD FOR CLEANING SUBSTRATE" do hereby declare that:

I am conversant with the English and Korean languages and a competent translator thereof.

To the best of my knowledge and belief, the following is a true and correct translation of the Relativity Document (No. P1999-44599) in the Korean language already filed with Korean Industrial Property Office on October 14, 1999.

Signed this 21th day of August, 2006

Kyung Gu KANG 

PATENT APPLICATION

DOCUMENT NAME: PATENT APPLICATION

TO: COMMISSIONER

DATE: October 14, 1999

TITLE OF THE INVENTION: APPARATUS AND METHOD FOR CLEANING
SUBSTRATE

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The present application is filed pursuant to Article 42 of the
Korea Patent Act.

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[ABSTRACTS]

[ABSTRACT]

A substrate cleaning apparatus and a method that are adaptive for removing alien substances attached onto the lower and upper surfaces of a substrate as well as onto the side surface thereof.

The substrate cleaning apparatus includes upper and lower cleaning modules are arranged in such a manner to contact the upper and lower surfaces of the substrate and a side cleaning module is arranged at the side surface of the substrate.

Accordingly, alien substances sticking onto the upper and lower surfaces of the substrate as well as the side surface of the substrate can be removed to improve a fabrication yield of the liquid crystal panel.

[REPRESENTATIVE DRAWING]

Fig. 2

[SPECIFICATION]

[TITLE OF THE INVENTION]

APPARATUS AND METHOD FOR CLEANING SUBSTRATE

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a diagram showing a configuration of a related art substrate cleaning apparatus; and

Fig. 2 is a diagram showing a configuration of a substrate cleaning apparatus according to an embodiment of the present invention.

<DETAILED DESCRIPTION OF THE REFERENCE NUMERALS>

20, 30: substrate	22, 34, 36: cleaning brush
32: side cleaning brush	38: Fine DI Mega Sonic

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[TECHNICAL FIELD INCLUDING THE INVENTION AND PRIOR ART THEREIN]

This invention relates to a substrate cleaning apparatus and a method, and more particularly to a substrate cleaning apparatus and a method that are adaptive for removing an alien substance attached to the upper and lower surface as well as the side surface of a substrate.

Generally, a liquid crystal display (LCD) panel is

completed by carrying out various processes such as a formation process of a thin film transistor (TFT) consisting of coating of an electrode material, a semiconductor layer and an insulating film on a substrate, a bonding of the lower substrate to the upper substrate and an injection and sealing of liquid crystal, etc. In such various fabrication process of the LCD panel, sticking particles, such as substrate fragments, and various alien substances occasionally stick onto the substrate to contaminate the substrate. In order to reduce such a badness caused by the alien substances, a fabrication process of the LCD panel includes a substrate cleaning work for each step thereof. In connection with each fabrication process requiring a cleaning work of the substrate, the substrate cleaning work is performed before and after a step of forming a TFT array on the substrate, after a step of forming an orientation film and rubbing the orientation film for the purpose of making an orientation of a liquid crystal, after a scribe step of bonding the upper substrate with the lower substrate and then cutting away each panel from the wider substrate, and after a step of injecting a liquid crystal to the panel and sealing the injected portion.

Such a substrate cleaning work is carried out by means of a substrate cleaning module as shown in Fig. 1. Referring to Fig. 1, the related art substrate cleaning apparatus includes

cleaning brushes 22 for cleaning the upper and lower surfaces of a substrate 20. A pair of cleaning brushes 22 is provided at each of the upper and lower sides in such a manner to contact the upper and lower surfaces of the substrate 20. As shown in Fig. 1, the cleaning work is initiated by passing the substrate 20 between the upper and lower cleaning brushes 22 in an arrow direction. Then, the cleaning brushes 22 are rotated at a high speed to remove sticking particles and alien substances sticking onto the upper and lower surfaces of the substrate 20.

However, the related art substrate cleaning apparatus has a problem in that, since the clean brushes 22 have been formed to contact the upper and lower surfaces of the substrate 20, alien substances sticking onto the upper and lower surfaces of the substrate 20 only can be removed while alien substances sticking onto the side surface of the substrate 20 can not be removed. The glass substrate 20 used in the liquid crystal display panel has a thickness of about 0.7mm so that the side surface of the substrate 20 can be formed at a significant area. Thus, alien substances generated in various processes upon fabrication of the panel are attached to the upper and lower surfaces of the substrate 20 as well as to the side surface thereof. Particularly, in a scribe process of separating each panel from the wide substrate by a cutting work after a

formation of the TFT and a bonding of the upper substrate to the lower substrate or a grinder process of grinding the coarse side surface of the substrate 20 separated by the cutting work, minute particles and fragments of the substrate stick onto the side surface of the substrate 20 to contaminate the substrate 20. Such alien substances sticking onto the side surface of the substrate 20 act as a factor that raises a badness ratio upon fabrication of the panel to reduce a throughput and deteriorates a picture quality of the LCD panel.

[TECHNICAL SUBJECT MATTER TO BE SOLVED BY THE INVENTION]

Accordingly, it is an object of the present invention to provide a substrate cleaning apparatus and a method that are adapted to remove an alien substance attached to the upper and lower surface as well as the side surface of a substrate.

[CONFIGURATION AND OPERATION OF THE INVENTION]

In order to achieve these and other objects of the invention, a substrate cleaning apparatus according to one aspect of the present invention comprises upper and lower cleaning modules are arranged in such a manner to contact the upper and lower surfaces of the substrate and a side cleaning module is arranged at the side surface of the substrate.

A method of cleaning a substrate according to another

aspect of the present invention comprises the steps of rotating side cleaning brushes arranged in such a manner to contact the side surface of the substrate to remove alien substances sticking onto the side surface of the substrate; rotating upper and lower cleaning brushes arranged in such a manner to contact the upper and lower surfaces of the substrate, respectively, to remove alien substances sticking onto the upper and lower surfaces of the substrate; and jetting cleaning water carrying supersonic waves into the side surface of the substrate at a high pressure to clean the side surface of the substrate.

These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings, in which:

Hereinafter, the embodiment of the present invention is in detail explained with reference to Fig. 2.

Fig. 2 is a diagram showing a configuration of a substrate cleaning apparatus according to an embodiment of the present invention. Referring to Fig. 2, a substrate cleaning apparatus according to one aspect of the present invention includes upper cleaning brushes 34 and lower cleaning brushes for cleaning the upper and lower surfaces of a substrate 30, respectively, as well as side cleaning brushes 36 and a Fine DI Mega Sonic 38 for cleaning the side surface of the substrate 30.

The side cleaning brushes 32 mounted on the side surface of the substrate 30 is responsible for being rotated to remove alien substances sticking onto the side surface of the substrate. Also, the Fine DI Mega Sonic 38 jets a cleaning water carrying supersonic waves into the side surface of the substrate 30 at a high pressure to remove alien substances sticking onto the side surface of the substrate 30.

Hereinafter, an operation of the present substrate cleaning apparatus will be described. First, the substrate 30 is transferred between the upper and lower cleaning brushes 34 and 36 to progress in an arrow direction shown in Fig. 2. In this case, the side cleaning brushes 32 and the Fine DI Mega Sonic 38 are mounted within the cleaning module in such a manner to contact the side surface of the substrate 30. As the substrate 32 begins to progress in the arrow direction, the side cleaning brushes 32 contacting the side surface of the substrate 30 are rapidly rotated to primarily remove alien substances sticking onto the side surface of the substrate 30. Next, when the substrate 30 is being transferred, the upper and lower cleaning brushes 34 and 36 are rapidly rotated to remove alien substances sticking onto the upper and lower surfaces of the substrate 30. Finally, the Fine DI Mega Sonic 38 jets high-pressure cleaning water into the side surface of the substrate 30 to secondarily clean the side surface of the

substrate 30 again. In this case, the cleaning water jetted from a fine nozzle of the Fine DI Mega Sonic 38 is de-ionized water, which is carried with supersonic waves causing a minute vibration. Accordingly, the alien substances sticking onto the side surface of the substrate 30 can be completely removed by a high pressure of the cleaning water and a vibration from the supersonic waves.

By such a cleaning work using the side cleaning module, the present substrate cleaning apparatus can completely remove sticking particles or alien substances sticking onto the upper and lower surfaces of the substrate as well as the side surface of the substrate. Accordingly, a badness ratio caused by the alien substances upon fabrication of the LCD panel is dramatically reduced to improve a yield. A problem of picture quality deterioration caused by alien substances at the side surface of the substrate in the related art can be solved.

[EFFECT OF THE INVENTION]

As described above, according to the present invention, sticking particles or alien substances sticking onto the upper and lower surfaces of the substrate as well as the side surface of the substrate can be removed by means of the side brushes contacting the side surface of the substrate and a jet for jetting the cleaning water carrying supersonic waves at a high

pressure. Accordingly, a fabrication yield of the LCD panel is improved and a picture quality deterioration problem is solved.

Although the present invention has been explained by the embodiments shown in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention. Accordingly, the scope of the invention shall be determined only by the appended claims and their equivalents.

What is claimed is:

1. A substrate cleaning apparatus for cleaning a substrate in a liquid crystal display panel using a cleaning module arranged in such a manner to contact the upper and lower surfaces of the substrate, said apparatus comprising:

 a side cleaning module arranged at the side surface of the substrate.

2. The substrate cleaning apparatus as claimed in claim 1, wherein said side cleaning module is a brush-type cleaner being rotated to clean the side surface of the substrate.

3. The substrate cleaning apparatus as claimed in claim 2, wherein said side cleaning module further comprises:

 a cleaning water jet device for jetting cleaning water carrying supersonic waves into the side surface of the substrate at a high pressure.

4. A method of cleaning a substrate, comprising the steps of:

 rotating side cleaning brushes arranged in such a manner to contact the side surface of the substrate to remove alien

substances sticking onto the side surface of the substrate; rotating upper and lower cleaning brushes arranged in such a manner to contact the upper and lower surfaces of the substrate, respectively, to remove alien substances sticking onto the upper and lower surfaces of the substrate; and jetting cleaning water carrying supersonic waves into the side surface of the substrate at a high pressure to clean the side surface of the substrate.



FIG. 1

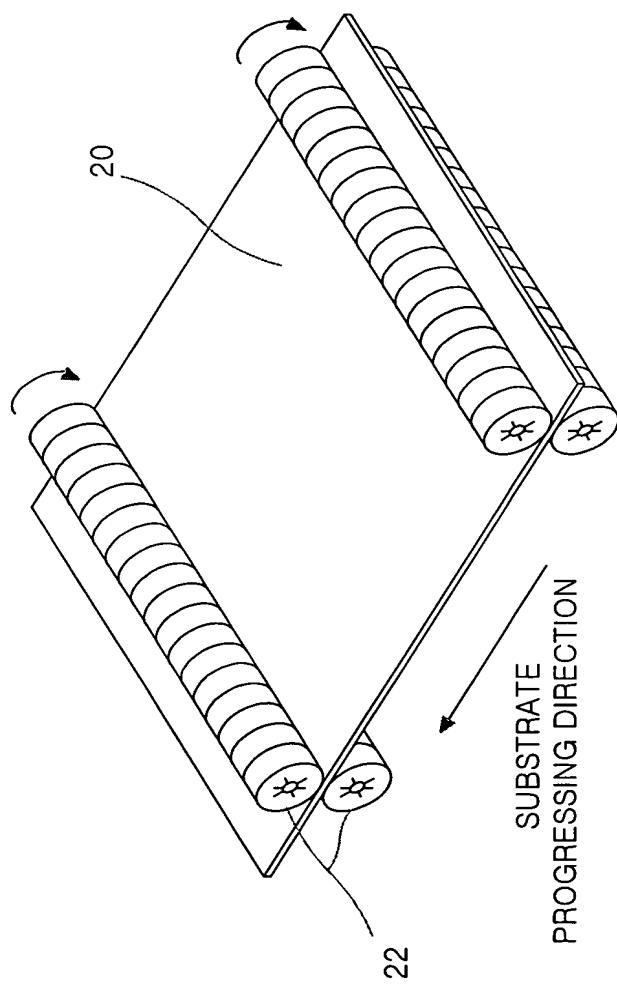


FIG.2

